2.8.2

May 1998 Groundwater Monitoring Results

TECHNICAL MEMORANDUM NO. GW-17

Reynolds Metals Company
TROUTDALE FACILITY

CH2MHILL

July 24, 1998

136583

PDX17E09.DOC

Contents

May 1998 Groundwater Monitoring Results

PREPARED FOR: Mike Leach/RMC
Steve Shaw/RMC

PREPARED BY: Taylor Gehweiler/CH2M HILL-PDX
Patty O'Connor/CH2M HILL-PDX

COPIES: Scott Dethloff/CH2M HILL-PDX
Doug Macauley/RMC
Jim McKinnon/RMC
Davi Richards/CH2M HILL-CVO
Ken Trotman/CH2M HILL-SEA
RMC File/CH2M HILL-PDX

DATE: July 24, 1998

Introduction

This technical memorandum presents the results of the May 1998 groundwater sampling event conducted at the Reynolds Metals Company (RMC) aluminum reduction facility in Troutdale, Oregon. The 1998 groundwater monitoring program is described in *Memorandum WP No. 40: Proposed 1998 Groundwater Monitoring Program* (CH2M HILL, February 4, 1998) and consists of three sampling events (February, May, and August 1998). *Memorandum WP No. 40* also describes the groundwater monitoring program rationale, groundwater sampling methods [including quality assurance/quality control (QA/QC) protocol], and management of investigation-derived waste. For a detailed description of the site, refer to *Technical Memorandum No. GW-12: August 1997 Quarterly Groundwater Monitoring Results* (CH2M HILL, December 18, 1997).

Other than the changes described below, the May 1998 sampling event proceeded as described in *Memorandum WP No. 40: Proposed 1998 Groundwater Monitoring Program* (see Table 1). The May 1998 event focused on two areas of the site: the bakehouse area and the rivers. Seventeen monitoring wells [seven shallow silt wells, nine shallow upper gray sand (UGS) wells, and one intermediate-depth sand well] were purged and sampled during the week of May 11, 1998. Three of these wells are located along the Columbia and Sandy rivers; the other 14 are around the perimeter of the bakehouse.

As indicated in Table 1[a], the bakehouse area wells were sampled for the following constituents:

- Fluoride (measured in the field with a field fluoride selective-ion probe)
- Volatile organic compounds (VOCs)

[a] Note: Because of their number and size, tables and figures are presented at the end of this technical memorandum.

On the basis of the preliminary screening of groundwater north of the dike [see Tables 3-5 and 3-11 in the *Surface Water and Sediment Areas Addendum to the RI/FS Work Plan* (CH2M HILL, April 3, 1998)], data needs were identified related to assessing constituent migration to the Columbia and Sandy rivers. To address these needs, 12 total and dissolved metals, total cyanide, and chromium VI were added to the analyte list for river wells MW51-069, MW52-045, and MW53-034 (see Table 1). The river wells were sampled for the following constituents in May 1998:

- Fluoride (measured in the field with a field fluoride selective-ion probe).
- Twelve total metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and silver).
- Twelve dissolved metals (aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and silver). If total metals were detected above their detection limits, field filtered samples were analyzed for dissolved metals.
- Chromium VI.
- Total cyanide (at wells MW51-069 and MW52-045 only). If total cyanide was detected above the detection limit, then the sample was analyzed for amenable cyanide.

All three river wells were sampled on the same day, and the samples were shipped directly to the lab that evening because chromium VI has a short holding time (24 hours). Chromium VI samples were collected in lab-provided, unpreserved sample bottles and were not field filtered. One duplicate sample was collected at MW52-045 for QA/QC because MW52-045 has parameters that were not monitored in other wells.

May 1998 Groundwater Analytical Results

This section provides a general summary of data (by unit) for the May 1998 sampling event. Seventeen of the existing 93 site monitoring wells were sampled during this sampling event:

- A total of 16 shallow wells were sampled (seven wells screening silt; seven wells screening the UGS in the bakehouse area, and two UGS river boundary wells).
- One intermediate-depth river boundary well was sampled.

Groundwater analytical results for these wells are compared with published U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) for drinking water.

Risk-based protective concentrations or practicable attainment criteria have not yet been developed for groundwater beneath the RMC site. MCLs may or may not prove to be appropriate or practical; therefore, they are used here for the purpose of discussion only. If MCLs are not available for a constituent, the results are compared with secondary maximum contaminant levels (SMCLs), if provided; SMCLs address aesthetic concerns such as taste and odor.

Table 2 lists parameters measured in the field during the sampling event. These field parameters include specific conductance, temperature, pH, turbidity, field fluoride, and Eh.

MCL exceedances for the May 1998 sampling event are presented in Table 3. Fluoride was the only constituent that exceeded MCLs; other metals listed in Table 3 are compared to SMCLs because no primary MCLs are available for these metals. Table 4 summarizes the analytical results (by unit) for the May 1998 sampling event.

Shallow Monitoring Wells

Shallow monitoring well analytical results are summarized below.

Shallow Monitoring Wells Screening Silt

Analytical results for samples collected from the Bakehouse area silt unit monitoring wells are presented in Table 4. Five wells were successfully sampled during the May 1998 sampling event; two wells (MW42-013 and MW44-011) went dry during purging.

Fluoride. Fluoride was detected in each of the five groundwater samples collected from the silt wells. These detections represent field-measured fluoride concentration values. [The detection limit for the field fluoride probe is 0.40 milligram per liter (mg/L)]. Fluoride concentrations detected in May 1998 ranged from 0.93 mg/L at MW41-020 to 16.80 mg/L at MW46-018. The MCL for fluoride (4.0 mg/L) was exceeded at four of the monitoring wells, as shown in Table 3; these exceedances are also indicated by bold text in Table 4.

VOCs. During the May 1998 sampling event, two silt well locations were sampled for VOCs (MW42-013 and MW43-015). MW42-013 went dry during the purging phase prior to sampling, and no representative shallow silt groundwater sample could be collected. No VOCs were detected at MW43-015 (Table 4).

Shallow Monitoring Wells Screening the Upper Gray Sand

May 1998 analytical results for samples collected from shallow UGS monitoring wells are presented in Table 4.

Fluoride. Fluoride was detected at each of the nine UGS monitoring wells sampled, at concentrations ranging from 0.86 mg/L (MW46-043) to 17.20 mg/L (MW42-027). The MCL for fluoride (4.0 mg/L) was exceeded at three of the nine well locations (see bold text in Table 4 and UGS well locations listed in Table 3).

Cyanide and Chromium VI

Laboratory analysis was performed for chromium VI for groundwater samples collected from MW52-045 and MW53-034 in May 1998. Cyanide analysis was performed on samples from MW52-045 only. No detections were reported at either location for these two constituents.

Twelve Metals. Two samples collected from river boundary UGS wells (MW52-045 and MW53-034) were analyzed for metals in May 1998. Several metals were detected in these two samples (see Tables 3 and 4). No MCLs were exceeded. However, in MW52-045, SMCLs were exceeded for total aluminum (0.0811 mg/L), dissolved aluminum (0.0739 mg/L), total iron (7.06 mg/L), dissolved iron (7 mg/L), total manganese (0.427 mg/L), and dissolved manganese (0.428 mg/L). Metals were also detected in MW53-069, where SMCLs were exceeded for total aluminum (0.0747 mg/L), total iron (12.2 mg/L), dissolved iron

(12 mg/L), total manganese (0.666 mg/L), and dissolved manganese (0.659 mg/L). The SMCLs for these metals are as follows: 0.05 mg/L for aluminum, 0.3 mg/L for iron, and 0.05 mg/L for manganese.

VOCs. VOCs were detected in the one UGS groundwater sample (MW41-033) collected for VOCs analysis in May 1998 (see Table 4). VOC detections in MW41-033 included the following:

- Tetrachloroethene at 0.0012 mg/L
- Toluene at 0.00018J mg/L ("J" indicates that the value is estimated.)

The MCLs for these constituents are 0.005 mg/L for tetrachloroethene and 1.0 mg/L for toluene. Both values were below MCLs.

Intermediate-Depth Monitoring Wells

Table 4 shows the May 1998 groundwater analytical results for the one monitoring well (river boundary well MW51-069) screened in the intermediate-depth sand.

Fluoride

Fluoride was not detected at MW51-069 during the May 1998 sampling event (see Table 4).

Cyanide and Chromium VI

Laboratory analysis was performed for cyanide and chromium VI for groundwater samples collected from MW51-069 in May 1998. No detections were reported.

Twelve Metals

Various metals were detected in the one intermediate-depth groundwater sample analyzed for metals in May 1998 (Table 4). None of the metals detected exceeded MCLs (see Table 3). However, SMCLs were exceeded for total iron (24 mg/L), dissolved iron (24.1 mg/L), total manganese (0.923 mg/L), and dissolved manganese (0.927 mg/L). Total arsenic was detected at 0.0009 mg/L, below the MCL.

Deep Monitoring Wells

No groundwater samples were collected from the deep groundwater zone during the May 1998 sampling event.

Horizontal Groundwater Elevation Data/Contour Maps

The May 4, 1998, groundwater elevations are listed in Table 5. Corresponding groundwater elevation contour maps are shown for silt (Figure 1), UGS (Figure 2), intermediate-depth sand (Figure 3), and deep sand/gravel (Figure 4).

Previous data collected from RMC-Troutdale indicate that Columbia River stage fluctuations occur in response to tidal fluctuations, precipitation events, and dam releases. These stage fluctuations can cause temporary horizontal hydraulic gradient reversals, primarily north of the dike in the deep sands. Data collected at this site demonstrate that these fluctuations do not exist long enough to have a significant impact on long-term

groundwater flow directions. The 24-hour average Columbia River stage level will be considered in the construction of the 1998 water elevation contour maps, as recommended in Appendix C, "Analysis of Columbia River Stage Fluctuations and Effects on Nearby Groundwater Elevations," of the *Surface Water and Sediment Addendum to the RI/FS Work Plan* (CH2M HILL April 3, 1998).

The May 1998 Columbia River level was obtained by calculating a 24-hour average stage using datalogger data. The average for a time *t* was computed by adding the previous 23 stage measurements to the measurement at time *t*, and dividing by 24. The use of an average Columbia River stage smoothes the daily tidal maximums and minimums. However, it should be noted that most gradient reversals are caused by changes in dam releases and/or precipitation events, not by tidal fluctuations.

May 1998 groundwater elevation horizontal hydraulic gradients across the site are very flat, especially for the deeper zones. The Columbia River monitoring data indicate that the seasonal upward trend in river levels generally began in mid- to late April and continued through the May sampling event. River levels had been increasing rapidly just prior to the May sampling event in response to increasing dam releases designed to regulate the larger flows resulting from precipitation and snowmelt. During the rapid river rise, the river level increased approximately 2 feet in the 4 days preceding the sampling event.

Based on the flat gradient and rapidly rising Columbia River levels, both the manual measurement elevation and the 24-hour average elevations for the Columbia River are provided on the groundwater elevation contour maps in Figures 1 through 4.

Shallow Monitoring Wells

The silt and UGS groundwater elevation data are discussed separately below. The contour maps were prepared using data collected from 32 shallow wells screening the silt and 28 UGS wells.

Shallow Monitoring Wells Screening Silt

Groundwater elevation contours for the shallow wells screening silt are shown in Figure 1. Groundwater elevations measured on May 4, 1998, ranged from approximately 14.9 feet in the western portion of the site (MW15) to 26.8 feet in the eastern portion (MW05). The estimated horizontal hydraulic gradient across the southern portion of the site is similar to February 1998 horizontal gradients.

The low groundwater levels near the central portion of the site (15-foot contour line) may be a result of bakehouse dewatering activities. With the exception of the northern portion of the site (refer to the UGS section below), the May 1998 groundwater levels and flow directions appear to be consistent with data collected during May 1997.

Groundwater near the south wetlands appears to flow from east to west. It is likely that the wetland is a local groundwater discharge area from all directions, particularly during periods of elevated groundwater levels.

Shallow Monitoring Wells Screening the Upper Gray Sand

Groundwater elevation contours for the 28 shallow wells screening the UGS are shown in Figure 2. Groundwater elevations measured on May 4, 1998, indicate a generally flat hydraulic gradient across the site.

North of the U.S. Army Corps of Engineers (COE) dike, the nearshore area is highly influenced by the Columbia River stage as the river rapidly rises in response to precipitation and seasonal snowmelt. A groundwater trough or divide, centered on MW23-025, results from groundwater elevations lagging behind the rapidly rising Columbia River stage. The depression feature is believed to be a result of rising river levels that have caused nearshore groundwater levels to rise rapidly. Groundwater levels at wells more distant from the river rise less rapidly; in effect, they lag behind levels in the wells closer to the river, creating the observed nearshore hydraulic gradient reversal and the resulting groundwater depression. This groundwater flow pattern is considered temporary and will dissipate as the river stage stabilizes.

North of the dike, the groundwater elevation contours are constructed assuming little influence from Company Lake. This interpretation is based on the low permeability values of the materials collected from the bottom of the lake and the approximately 3- to 4-foot difference between the lake elevation (approximately 15.5 feet) and groundwater elevations at nearby monitoring wells.

South of the dike and consistent with February 1998 data, a localized groundwater mound is observed north of the bakehouse in the central portion of the site. This observation is based on groundwater levels from the new monitoring wells (MW40 through MW46). Groundwater flows radially away from this area (contour interval is 0.50 foot).

Intermediate-Depth Monitoring Wells

Groundwater elevation contours for the monitoring wells that screen the intermediate-depth sand are shown in Figure 3. Groundwater elevations measured on May 4, 1998, indicate a generally flat hydraulic gradient across the interior plant area (south of the COE dike). Similar to the UGS groundwater flow pattern, the groundwater flow directions north of the dike reflect a nearshore hydraulic gradient reversal, probably in response to the rapidly rising Columbia River stage. As a result of the gradient reversal, a groundwater trough or depression is observed near MW08-127 and MW21-063. In addition, the rising river stage has resulted in a hydraulic gradient reversal, or inland groundwater flow direction, along the perimeter of the site (see Figure 3). This groundwater flow pattern is considered temporary and will dissipate as the river stage stabilizes.

The hydraulic gradient in the intermediate-depth sand is generally similar to gradients observed in the UGS. The intermediate-depth sand monitoring wells are generally screened in the gray sand between 80 and 100 feet below ground surface (bgs).

Deep Monitoring Wells

Groundwater elevation contours for the deep monitoring wells are shown in Figure 4. The deep monitoring wells are generally screened from 145 to 180 feet bgs. Deep monitoring wells in the southern portion of the site are generally completed in the gray sand unit, while wells in the northern portion of the site are completed in sand and gravels.

With the exception of the eastern portion of the site, May groundwater elevation measurements indicate a generally flat hydraulic gradient. In the eastern portion of the site, a groundwater depression is centered near monitoring well MW33-165. The groundwater depression is primarily the result of plant production well operation. At the time the groundwater elevation data were collected, four production wells were in operation: PW3 at 425 gallons per minute (gpm); PW7 at 775 gpm; PW8 at 800 gpm; and PW10 at 400 gpm (discharge rates are approximate). Plant water demand increased from February with the startup of aluminum reduction (one potline) at the facility.

As observed in the shallower groundwater horizons, the rising river stage has established a nearshore hydraulic gradient reversal resulting in the broad northwest-trending groundwater low in the Company Lake area. This groundwater flow pattern is considered temporary and will dissipate as the river stage stabilizes.

References

CH2M HILL. *Technical Memorandum No. GW-12: August 1997 Quarterly Groundwater Monitoring Results.* Prepared for Reynolds Metals Company, Troutdale, Oregon. December 18, 1997.

_____. *Memorandum WP No. 40: Proposed 1998 Quarterly Groundwater Monitoring Program.* Prepared for Reynolds Metals Company, Troutdale, Oregon. February 4, 1998.

_____. *Surface Water and Sediment Addendum to the RI/FS Work Plan,* Appendix C, "Analysis of Columbia River Stage Fluctuations and Effects on Nearby Groundwater Elevations." Prepared for Reynolds Metals Company, Troutdale, Oregon. April 3, 1998.

_____. *Technical Memorandum No. GW-14: May 1998 Quarterly Groundwater Monitoring Results.* Prepared for Reynolds Metals Company, Troutdale, Oregon. May 26, 1998.

Tables

Table 1
May 1998 Groundwater Sampling Event
Reynolds Metals Company - Troutdale, Oregon

Area Monitored	Well ID	Installation Date	Sampling Date	Field Fluoride [a]	12 Metals [b]	VOCs [c]	Cyanide [d]	Chromium VI [e]
Bakehouse	MW40-018	6/11/97	May-98	x				
	MW40-030	6/11/97	May-98	x				
	MW41-020	6/13/97	May-98	x				
	MW41-033	6/12/97	May-98	x		x		
	MW42-013	6/11/97	May-98	x		x		
	MW42-027	6/11/97	May-98	x				
	MW43-015	6/13/97	May-98	x		x		
	MW43-027	6/13/97	May-98	x				
	MW44-011	6/12/97	May-98	x				
	MW44-027	6/12/97	May-98	x				
	MW45-017	6/17/97	May-98	x				
	MW45-042	6/16/97	May-98	x				
	MW46-018	6/16/97	May-98	x				
	MW46-043	6/16/97	May-98	x				
Columbia River and Fluoride-Plume Perimeter	MW51-069	11/3/97	May-98	x	x		x	x
	MW52-045	10/31/97	May-98	x	x		x	x
Sandy River and Fluoride-Plume Perimeter	MW53-034	10/30/97	May-98	x	x			x

Notes:

[a] Measured using Orion selective-ion probe.

[b] EPA CLP Method. Both total (unfiltered groundwater samples) and dissolved (field-filtered groundwater samples) will be collected. If total metals are detected or field-measured turbidity is greater than 5 nephelometric turbidity units (NTUs), then the dissolved metals samples will be analyzed. The twelve metals are: aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and silver.

[c] EPA Method 524.2/CLP

[d] SW9010 If total cyanide is detected above the detection limit, then analyze the sample for amenable cyanide.

[e] SW7196 Chromium VI has a holding time of 24 hours.

Table 2
May 1998 Field Parameters Data Summary
Reynolds Metals Company - Troutdale, Oregon

Well ID	Unit [a]	Date	Purge Volume (gallons)	Sample Time	pH (-log [H+])	Temperature (°C)	Turbidity (NTUs)	Specific Conductance [b] (µmhos/cm)	Eh (millivolts)	Field Fluoride [c] (mg/L)
MW40-018	S	5/11/98	1.1	10:04 AM	6.53	16.2	22	191	219	5.7
MW41-020	S	5/12/98	2.5	1:08 PM	6.57	14.7	39	208	19	0.93
MW42-013	S	Not sampled - Well is Dry								
MW43-015	S	5/13/98	0.9	9:41 AM	6.21	15.1	9	157	221	9.5
MW44-011	S	Not sampled - Well is Dry								
MW45-017	S	5/12/98	1.9	10:34 AM	6.57	14.5	14	365	43	9.2
MW46-018	S	5/12/98	3.6	12:20 PM	6.42	17.6	1.6	1953	58	16.8
MW40-030	UGS	5/11/98	3.2	11:05 AM	6.56	17.7	1	386	160	1.49
MW41-033	UGS	5/13/98	4.5	10:40 AM	6.71	14.9	1.6	306	190	0.91
MW42-027	UGS	5/11/98	4.5	4:35 PM	6.55	16.4	0.8	202	68	17.2
MW43-027	UGS	5/13/98	4.5	9:24 AM	6.36	16.5	0.7	166	231	8.1
MW44-027	UGS	5/12/98	3.5	9:49 AM	6.60	12.1	1.40	130	189	3.8
MW45-042	UGS	5/12/98	7	11:14 AM	7.22	15.5	1	504	-124	0.88
MW46-043	UGS	5/12/98	7	12:02 PM	6.43	20.8	3	214	-32	0.86
MW52-045	UGS	5/11/98	11.5	2:17 PM	6.63	12.1	0.7	392	-96	6.11
MW53-034	UGS	5/11/98	8.0	1:06 PM	6.84	11.2	1.2	249	-102	2.49
MW51-069	I	5/11/98	13.5	3:44 PM	6.94	13.3	0.9	415	-151	0.40 U

Notes:

(a) S = Shallow well screened in silt.
UGS = Shallow well screened in the upper gray sand.
I = Intermediate-depth well screened in sand.

(b) Specific conductance is electrical conductivity normalized to 25°C.

°C = degrees Celsius
mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter
NA = not available
NTUs = nephelometric turbidity unit

(c) The detection limit of the field fluoride probe is 0.4 mg/L. Values below 0.4 mg/L are reported as nondetects, 0.40 U.

Table 3
May 1998 MCL Exceedances in Groundwater
Reynolds Metals Company - Troutdale, Oregon

Station Id: / Date Sampled: / Screened Material:	MCL (mg/L)	MW40-018 5/12/98 S	MW43-015 5/12/98 S	MW45-017 5/11/98 S	MW46-018 5/12/98 S	MW42-027 5/11/98 UGS	MW43-027 5/13/98 UGS	MW51-069 5/11/98 I	MW52-045 5/11/98 UGS	MW53-034 5/11/98 UGS
Conventional Parameters (mg/L)										
Fluoride by Field Method	4.0	5.7	9.5	9.2	16.8	17.2	8.1		6.11	
Metals (mg/L) [a]										
Aluminum (dissolved) [b]	0.05								0.0739	
Aluminum (total) [b]	0.05								0.0811	0.0747
Iron (dissolved) [b]	0.3							24.1	7	12
Iron (total) [b]	0.3							24	7.06	12.2
Manganese (dissolved) [b]	0.05							0.927	0.428	0.659
Manganese (total) [b]	0.05							0.923	0.427	0.666

Notes:
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
Screened Material: S = Shallow Silt Unit; UGS = Shallow Upper Gray Sand Unit;
I = Intermediate-depth Sand Unit

[a] Groundwater samples were analyzed for dissolved metals if total metals were reported above the laboratory method reporting limit.

[b] No primary MCL established for this constituent. Posted MCL is secondary.

Table 4
Monitoring Well Analytical Results for May 1998
Reynolds Metals Company—Troutdale, Oregon

Station ID:	MW40-018	MW41-020	MW43-015	MW45-017	MW46-018	MW40-030	MW41-033	MW42-027	MW43-027	MW44-027	MW45-042	MW46-043	MW52-045	MW53-034	MW51-069
Date Sampled:	5/11/98	5/12/98	5/13/98	5/12/98	5/12/98	5/11/98	5/13/98	5/11/98	5/13/98	5/12/98	5/12/98	5/12/98	5/11/98	5/11/98	5/11/98
Screened Material:	Shallow Silt					Shallow, Upper Gray Sand									Intermed
Conventional Parameters (mg/L)															
Chromium (VI)													0.4 U	0.4 U	0.4 U
Cyanide, Total													0.004 U		0.004 U
Fluoride by Field [a]	**5.7**	0.93	**9.5**	**9.2**	**16.8**	1.49	0.91	**17.2**	**8.1**	3.8	0.91	0.86	**6.11**	2.49	0.40 U
Metals, Total (mg/L)															
Aluminum [b]													**0.0811**	**0.0747**	0.015 U
Arsenic													0.0007 U	0.0007 U	0.0009
Beryllium													0.001 U	0.001 U	0.001 U
Cadmium													0.0001 U	0.0001 U	0.0001 U
Chromium													0.004 U	0.004 U	0.004 U
Copper													0.001 U	0.0014	0.001 U
Iron [b]													**7.06**	**12.2**	**24**
Lead													0.0008 U	0.0008 U	0.0008 U
Manganese [b]													**0.427**	**0.666**	**0.923**
Mercury													0.0001 U	0.0001 U	0.0001 U
Nickel													0.006 U	0.006 U	0.006 U
Silver													0.002 U	0.0021 U	0.002 U
Metals, Dissolved (mg/L)															
Aluminum [b]													**0.0739**	0.0163	
Arsenic															0.0007 U
Copper														0.001 U	
Iron [b]													**7**	**12**	**24.1**
Manganese [b]													**0.428**	**0.659**	**0.927**
Silver														0.002 U	
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane			0.001 U				0.001 U								
1,1,1-Trichloroethane			0.001 U				0.001 U								
1,1,2,2-Tetrachloroethane			0.001 U				0.001 U								
1,1,2-Trichloroethane			0.001 U				0.001 U								
1,1-Dichloroethane			0.001 U				0.001 U								
1,1-Dichloroethene			0.001 U				0.001 U								
1,1-Dichloropropene			0.001 U				0.001 U								

Table 4
Monitoring Well Analytical Results for May 1998
Reynolds Metals Company—Troutdale, Oregon

Station ID:	MW40-018	MW41-020	MW43-015	MW45-017	MW46-018	MW40-030	MW41-033	MW42-027	MW43-027	MW44-027	MW45-042	MW46-043	MW52-045	MW53-034	MW51-069
Date Sampled:	5/11/98	5/12/98	5/13/98	5/12/98	5/12/98	5/11/98	5/13/98	5/11/98	5/13/98	5/12/98	5/12/98	5/12/98	5/11/98	5/11/98	5/11/98
Screened Material:	Shallow Silt					Shallow, Upper Gray Sand									Intermed
1,2,3-Trichlorobenzene			0.001 U				0.001 U								
1,2,3-Trichloropropane			0.001 U				0.001 U								
1,2,4-Trichlorobenzene			0.001 U				0.001 U								
1,2,4-Trimethylbenzene			0.001 U				0.001 U								
1,2-Dibromo-3-Chloropropane			0.001 U				0.001 U								
1,2-Dibromoethane			0.001 U				0.001 U								
1,2-Dichlorobenzene			0.001 U				0.001 U								
1,2-Dichloroethane			0.001 U				0.001 U								
1,2-Dichloropropane			0.001 U				0.001 U								
1,3,5-Trimethylbenzene			0.001 U				0.001 U								
1,3-Dichlorobenzene			0.001 U				0.001 U								
1,3-Dichloropropane			0.001 U				0.001 U								
1,4-Dichlorobenzene			0.001 U				0.001 U								
2,2-Dichloropropane			0.001 U				0.001 U								
2-Chlorotoluene			0.001 U				0.001 U								
4-Chlorotoluene			0.001 U				0.001 U								
Benzene			0.001 U				0.001 U								
Bromobenzene			0.001 U				0.001 U								
Bromochloromethane			0.001 U				0.001 U								
Bromodichloromethane			0.001 U				0.001 U								
Bromoform			0.001 U				0.001 U								
Bromomethane			0.001 U				0.001 U								
Carbon Tetrachloride			0.001 U				0.001 U								
Chlorobenzene			0.001 U				0.001 U								
Chlorodibromomethane			0.001 U				0.001 U								
Chloroethane			0.001 U				0.001 U								
Chloroform			0.001 U				0.001 U								
Chloromethane			0.001 U				0.001 U								
Cis-1,3-Dichloropropene			0.001 U				0.001 U								
Dibromomethane			0.001 U				0.001 U								
Dichlorodifluoromethane			0.001 U				0.001 U								

Table 4
Monitoring Well Analytical Results for May 1998
Reynolds Metals Company—Troutdale, Oregon

Station ID:	MW40-018	MW41-020	MW43-015	MW45-017	MW46-018	MW40-030	MW41-033	MW42-027	MW43-027	MW44-027	MW45-042	MW46-043	MW52-045	MW53-034	MW51-069
Date Sampled:	5/11/98	5/12/98	5/13/98	5/12/98	5/12/98	5/11/98	5/13/98	5/11/98	5/13/98	5/12/98	5/12/98	5/12/98	5/11/98	5/11/98	5/11/98
Screened Material:	Shallow Silt					Shallow, Upper Gray Sand									Intermed
Ethylbenzene			0.001 U				0.001 U								
Hexachlorobutadiene			0.001 U				0.001 U								
Isopropylbenzene			0.001 U				0.001 U								
Methylene Chloride			0.002 U				0.002 U								
n-Butylbenzene			0.001 U				0.001 U								
n-Propylbenzene			0.001 U				0.001 U								
Naphthalene			0.001 U				0.001 U								
p-Isopropyltoluene			0.001 U				0.001 U								
Sec-Butylbenzene			0.001 U				0.001 U								
Styrene			0.001 U				0.001 U								
Tert-Butylbenzene			0.001 U				0.001 U								
Tetrachloroethene			0.001 U				0.0012								
Toluene			0.001 U				0.00018 J								
Trans-1,3-Dichloropropene			0.001 U				0.001 U								
Trichloroethene			0.001 U				0.001 U								
Trichlorofluoromethane			0.001 U				0.001 U								
Vinyl Chloride			0.001 U				0.001 U								
Xylenes, Total			0.001 U				0.001 U								

Notes:

Bold text indicates maximum contaminant level (MCL) exceedance (See footnote C, below).

U = compound not detected

J = estimated

mg/L = milligrams per liter

[a] The detection limit of the field fluoride probe is 0.40 mg/L. Values below 0.40 mg/L are reported as nondetects, 0.40 U.

[b] No primary MCL established for this constituent. In this case, bold numbers indicate secondary MCL exceedence.

[c] Groundwater samples were analyzed for dissolved metals because total metals were reported above the laboratory method reporting limit.

Table 5
May 4, 1998 Groundwater Elevation Data Summary
Reynolds Metals Company-Troutdale, Oregon

Well ID	Sample Time	Measuring Point Elevation *(a)*	Depth To Water *(b)*	Water Level Elevation *(a)*
MW01-019	10:30	28.25	9.15	19.10
MW02-012	9:40	31.10	11.86	19.24
MW02-034	9:40	30.64	17.95	12.69
MW03-017	9:30	29.69	4.19	25.50
MW03-098	9:30	30.65	18.27	12.38
MW03-175	9:30	30.72	18.34	12.38
MW04-019	11:25	26.91	11.21	15.70
MW05-025	9:50	33.99	7.19	26.80
MW06-024	11:05	26.81	13.71	13.10
MW06-094	11:00	27.85	15.65	12.20
MW06-176	11:05	27.74	15.47	12.27
MW07-024	11:45	28.38	7.62	20.76
MW08-027	11:30	25.32	12.79	12.53
MW08-127	11:30	25.62	13.61	12.01
MW08-169	11:30	25.88	13.76	12.12
MW09-030	11:40	29.27	18.05	11.22
MW10-023	10:15	30.28	9.42	20.86
MW10-090	10:15	31.03	18.65	12.38
MW10-165	10:15	31.24	19.89	11.35
MW11-017	9:50	31.61	6.52	25.09
MW12-021	11:20	22.53	8.63	13.90
MW12-092	11:20	22.57	10.25	12.32
MW12-184	11:20	23.04	10.80	12.24
MW13-022	10:25	30.88	16.11	14.77
MW14-015	10:10	30.88	6.58	24.30
MW15-024	11:15	22.75	7.82	14.93
MW15-086	11:15	23.88	11.71	12.17
MW15-175	11:15	23.88	11.71	12.17
MW16-014	9:35	28.91	7.43	21.48
MW17-016	9:22	27.13	9.89	17.24
MW17-028	9:20	27.30	10.21	17.09
MW18-016	9:10	23.98	8.57	15.41
MW18-031	9:10	23.95	11.64	12.31
MW19-013	9:30	27.10	7.06	20.04
MW20-026	12:00	28.46	17.17	11.29
MW21-012	11:50	24.54	7.92	16.62
MW21-025	11:50	24.60	13.20	11.40
MW21-063	11:50	26.76	15.05	11.71
MW21-176	11:50	26.01	13.98	12.03
MW22-027	11:45	25.35	14.34	11.01
MW23-025	11:47	26.41	15.45	10.96
MW24-010	10:25	30.13	9.38	20.75
MW25-024	9:45	31.14	11.25	19.89
MW25-035	9:45	30.89	18.20	12.69
MW26-012	9:25	26.26	4.34	21.92

Table 5
May 4, 1998 Groundwater Elevation Data Summary
Reynolds Metals Company-Troutdale, Oregon

Well ID	Sample Time	Measuring Point Elevation *(a)*	Depth To Water *(b)*	Water Level Elevation *(a)*
MW27-045	11:35	31.66	20.02	11.64
MW27-081	11:35	31.93	19.77	12.16
MW27-176	11:35	31.94	19.94	12.00
MW28-160	10:35	28.62	16.35	12.27
MW29-033	11:20	29.75	16.94	12.81
MW29-090	11:20	30.65	18.50	12.15
MW29-179	11:20	30.66	18.65	12.01
MW30-030	9:57	34.07	22.34	11.73
MW30-100	9:55	34.06	21.72	12.34
MW31-034	10:20	25.60	13.24	12.36
MW31-095	10:21	25.00	12.70	12.30
MW32-040	11:05	28.44	15.63	12.81
MW32-095	11:05	28.31	16.15	12.16
MW32-165	11:05	28.40	16.25	12.15
MW33-033	10:20	29.92	17.57	12.35
MW33-095	10:20	30.56	18.34	12.22
MW33-165	10:20	30.68	20.77	9.91
MW34-038	10:00	32.12	19.49	12.63
MW35-038	10:00	31.56	18.87	12.69
MW36-006	9:20	21.68	5.64	16.04
MW37-012	9:15	21.48	6.28	15.20
MW37-030	9:15	21.32	9.08	12.24
MW38-007	11:10	22.56	6.94	15.62
MW38-035	11:10	23.07	10.65	12.42
MW39-095	10:30	25.18	12.77	12.41
MW40-018	11:00	28.42	14.91	13.51
MW40-030	11:00	28.29	15.47	12.82
MW41-020	11:05	28.65	14.70	13.93
MW41-033	11:05	28.71	15.44	13.27
MW42-013	11:00	31.04	0.00	30.08
MW42-027	11:00	31.13	17.35	12.82
MW43-015	10:55	31.88	16.81	14.10
MW43-027	10:55	31.70	17.63	13.09
MW44-011	10:45	31.10	0.00	31.11
MW44-027	10:45	30.88	18.13	12.75
MW45-017	10:40	30.60	14.25	16.36
MW45-042	10:40	30.26	17.98	12.28
MW46-018	11:30	31.46	16.85	14.63
MW46-043	11:30	30.97	18.72	12.27
MW47-094	9:30	29.71	17.43	12.28
MW48-055	11:10	28.19	15.88	12.31
MW48-165	11:10	28.12	15.90	12.22
MW49-095	10:10	30.52	18.01	12.51
MW49-145	10:10	30.85	18.34	12.51
MW50-094	10:30	27.06	14.95	12.11

Table 5
May 4, 1998 Groundwater Elevation Data Summary
Reynolds Metals Company-Troutdale, Oregon

Well ID	Sample Time	Measuring Point Elevation *(a)*	Depth To Water *(b)*	Water Level Elevation *(a)*
MW51-069	10:00	26.17	13.64	12.53
MW52-045	11:25	26.43	13.70	12.73
MW53-034	12:05	23.80	10.96	12.84
Piezometers:				
PZ17-019	11:30	28.73	12.03	16.70
PZ17-039	11:30	28.70	16.50	12.20
PZ18-023	10:40	27.87	12.25	15.62
PZ18-040	10:40	27.81	15.58	12.23
PZ19-014	10:50	29.30	10.65	18.65
PZ19-040	10:50	29.43	36.84	-7.41
Staff Gauges:				
Columbia River	9:50	30.90	18.09	12.81*(c)*, 12.21 *(d)*
SG-CoLake	12:30	NA	NA	15.77
SG01	10:00	NA	NA	25.16
SG02	10:00	NA	NA	25.06
SG03	9:40	NA	NA	21.40
SG04	9:40	NA	NA	18.81
SG05	9:25	NA	NA	18.46
SG06	9:20	NA	NA	16.56
SG07	9:10	NA	NA	15.73
SG08	9:10	NA	NA	14.76
SD Pump Station	11:25	21.87	7.10	14.77
Other:				
FF06	10:40	24.64	12.18	12.46

Notes:

(a) Measuring Point Elevation (MPE) in feet 1929 National Geodetic Vertical Datum (NGVD).

(b) Depth to water in feet below MPE.

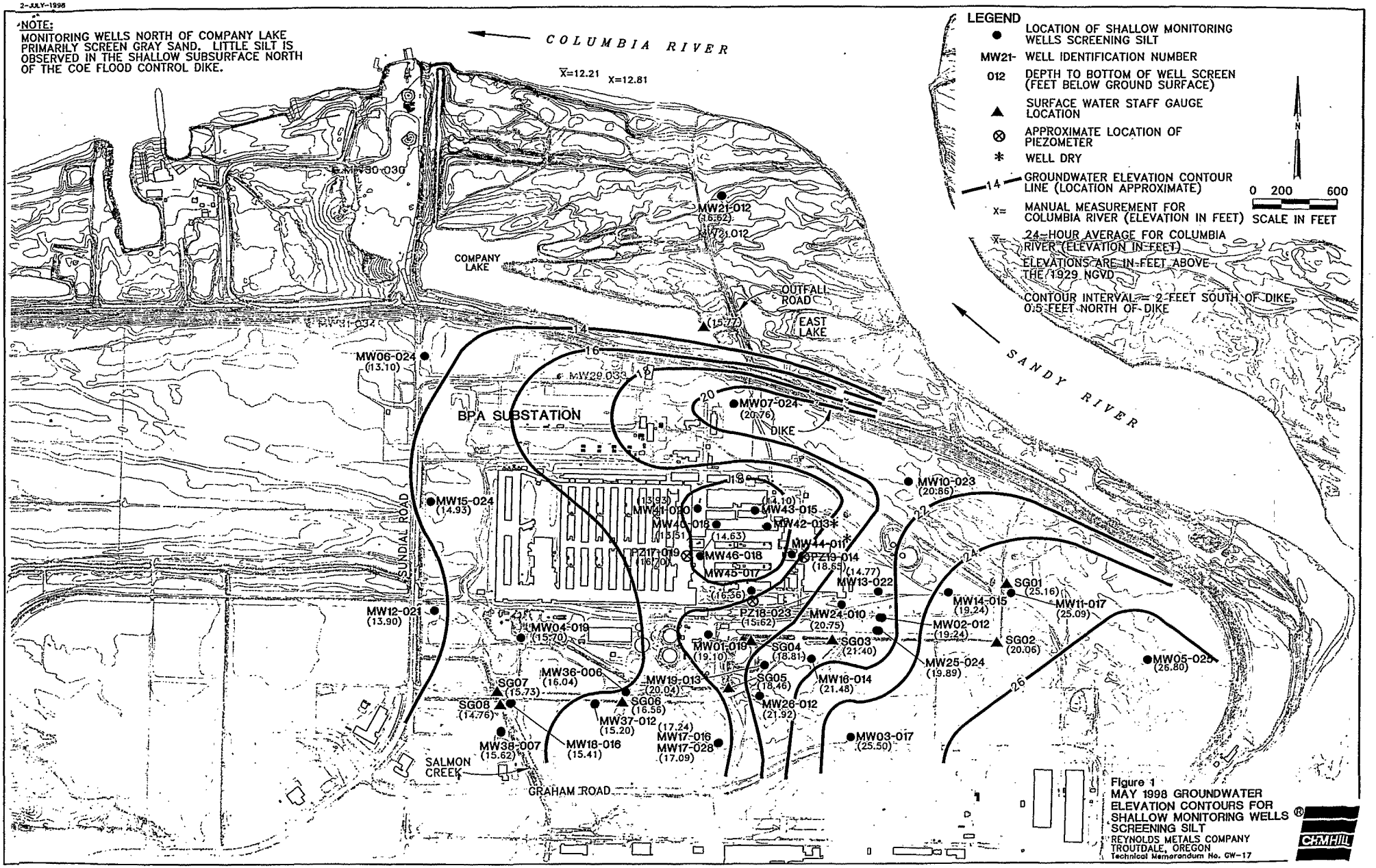
(c) Columbia River: manual measurement (feet).

(d) Columbia River: 24-hour average (feet).

FF = Fairview Farms

NA = Not applicable

Figures


2-JULY-1998
NOTE:
MONITORING WELLS NORTH OF COMPANY LAKE PRIMARILY SCREEN GRAY SAND. LITTLE SILT IS OBSERVED IN THE SHALLOW SUBSURFACE NORTH OF THE COE FLOOD CONTROL DIKE.
COLUMBIA RIVER
X=12.21
X=12.81
LEGEND
LOCATION OF SHALLOW MONITORING WELLS SCREENING SILT
MW21- WELL IDENTIFICATION NUMBER
012 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
SURFACE WATER STAFF GAUGE LOCATION
APPROXIMATE LOCATION OF PIEZOMETER
WELL DRY
14 GROUNDWATER ELEVATION CONTOUR LINE (LOCATION APPROXIMATE)
x= MANUAL MEASUREMENT FOR COLUMBIA RIVER (ELEVATION IN FEET)
24-HOUR AVERAGE FOR COLUMBIA RIVER (ELEVATION IN FEET)
ELEVATIONS ARE IN FEET ABOVE THE 1929 NGVD
CONTOUR INTERVAL = 2 FEET SOUTH OF DIKE, 0.5 FEET NORTH OF DIKE
N
0 200 600
SCALE IN FEET
MW30-030
MW21-012
(16.62)
MW21-032
COMPANY LAKE
OUTFALL
ROAD
(15.77)
EAST LAKE
MW06-024
(13.10)
MW29-033
SANDY RIVER
BPA SUBSTATION
MW07-024
(20.76)
DIKE
MW10-023
(20.86)
MW15-024
(14.93)
SUNDIAL ROAD
(13.93)
MW41-030
(14.10)
MW43-015
MW40-018
(15.51)
MW42-013
(14.63)
MW44-011
PZ17-019
(16.70)
MW46-018
PZ19-014
(18.65)
(14.77)
MW45-017
MW13-022
(16.36)
MW12-021
(13.90)
PZ18-023
(15.62)
MW24-010
(20.75)
MW14-015
(19.24)
SG01
(25.16)
MW11-017
(25.09)
MW04-019
(15.70)
MW01-019
(19.10)
SG04
(18.81)
SG03
(21.40)
MW02-012
(19.24)
SG02
(20.06)
MW25-024
(19.89)
MW05-025
(26.80)
MW36-006
(16.04)
SG07
(15.73)
MW19-013
(20.04)
SG05
(18.46)
MW16-014
(21.48)
SG08
(14.76)
SG06
(16.56)
MW26-012
(21.92)
MW37-012
(15.20)
(17.24)
MW17-016
MW17-028
(17.09)
MW03-017
(25.50)
MW38-007
(15.62)
MW18-016
(15.41)
SALMON CREEK
GRAHAM ROAD
Figure 1
MAY 1998 GROUNDWATER ELEVATION CONTOURS FOR SHALLOW MONITORING WELLS SCREENING SILT
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-17
CH2MHILL
9293WL1L.DWG

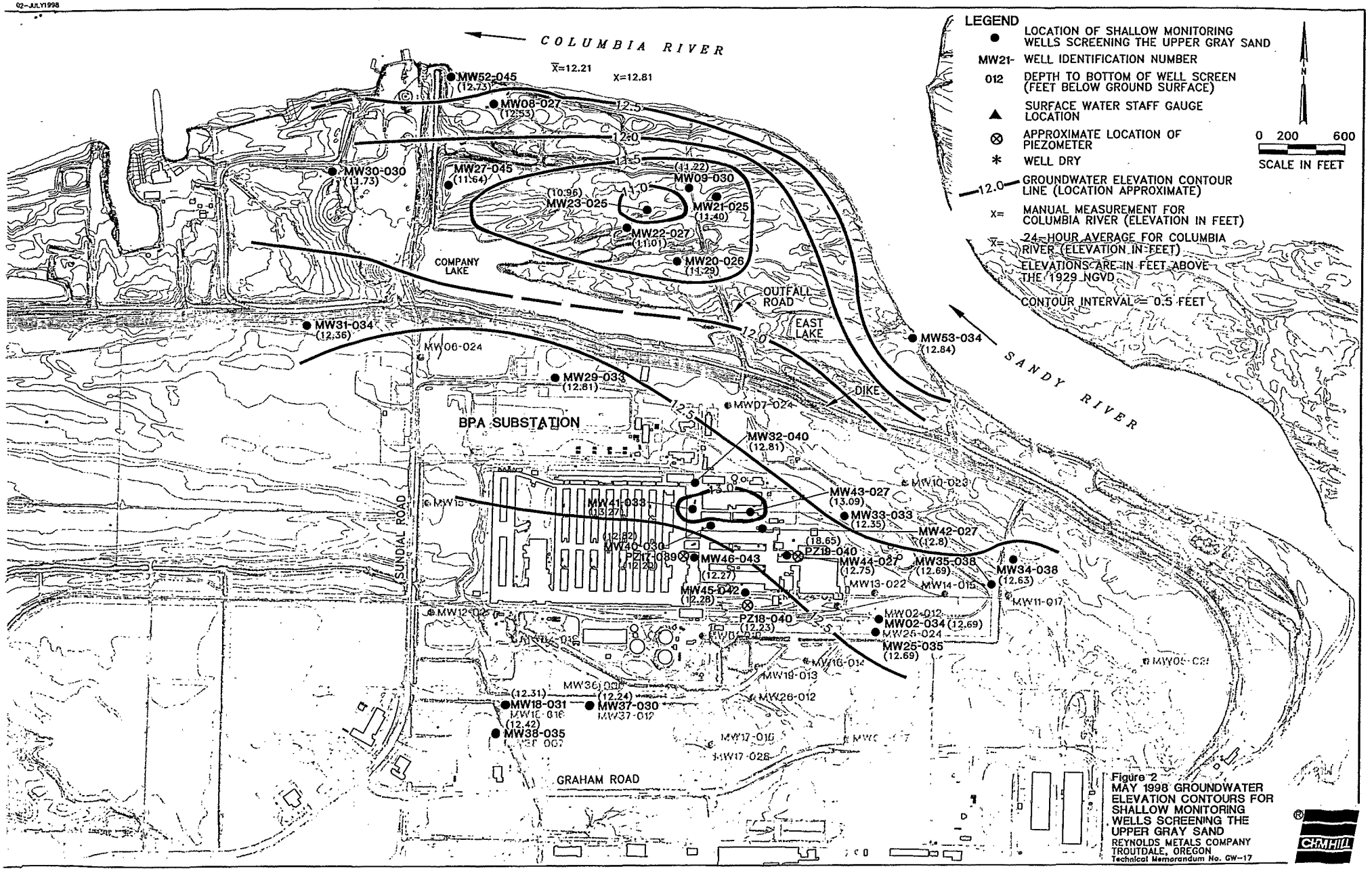


Figure 2
MAY 1998 GROUNDWATER ELEVATION CONTOURS FOR SHALLOW MONITORING WELLS SCREENING THE UPPER GRAY SAND
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-17

CH2MHILL

293W2L.DWG

02-JULY-1998

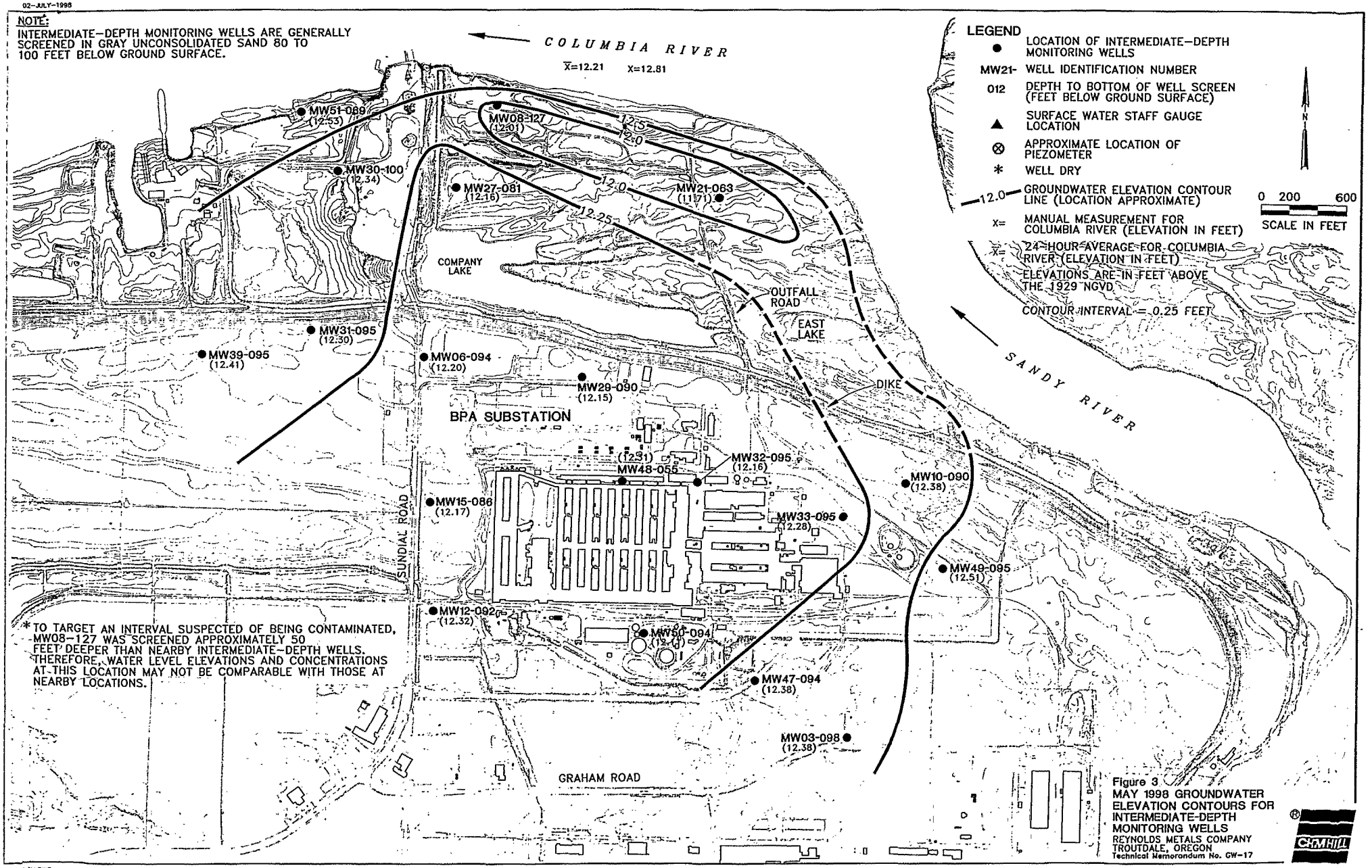


Figure 3
MAY 1998 GROUNDWATER ELEVATION CONTOURS FOR INTERMEDIATE-DEPTH MONITORING WELLS
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-17

CH2MHILL

9293vL.3M DWG

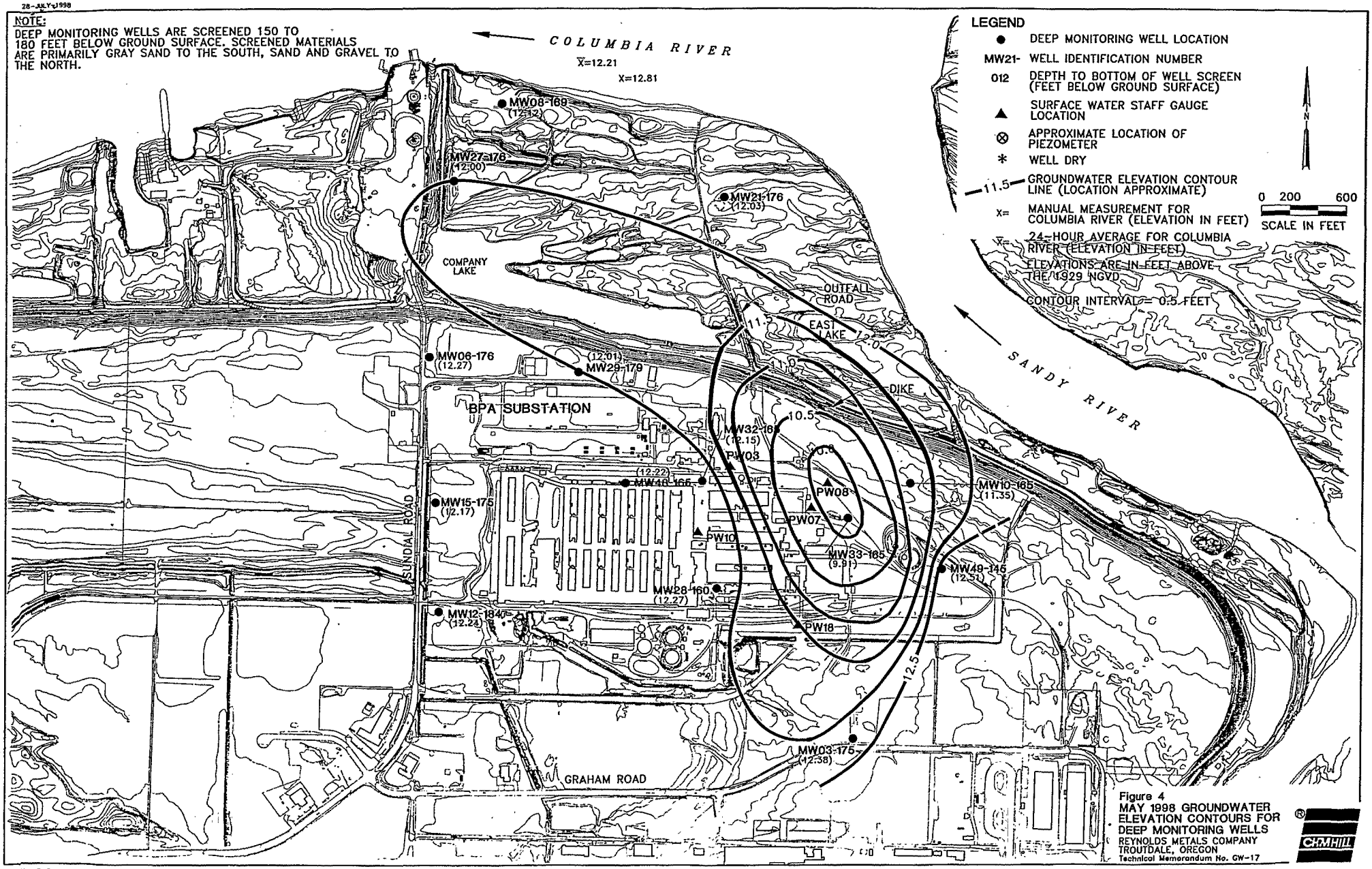


Figure 4
MAY 1998 GROUNDWATER ELEVATION CONTOURS FOR DEEP MONITORING WELLS
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-17

CH2MHILL